Data Sheet

CO2+T

Space and Duct CO_2 Sensors

Space and Duct CO_2 Sensors

Description

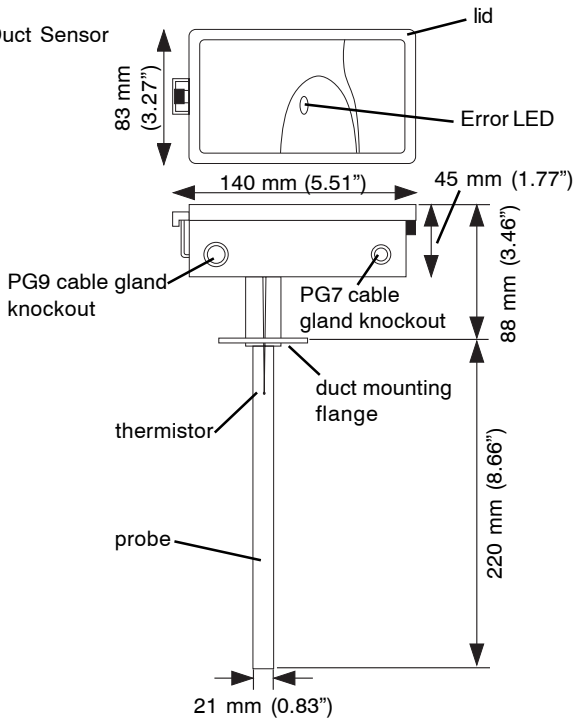
The CO_2 sensors monitor the temperature and carbon dioxide concentration in air. Duct and wall-mounting versions employ 'state of the art' non-dispersive infra-red technology with a membrane covered sample chamber resulting in stable, reliable, and highly accurate CO_2 measurements. The all-digital micro-processor based electronics facilitates easy configuration and calibration via an RS232 port connection. Programmable linear analogue outputs indicate temperature and CO_2 concentration making the sensors ideal for all CO_2 based ventilation control and monitoring applications.

Features

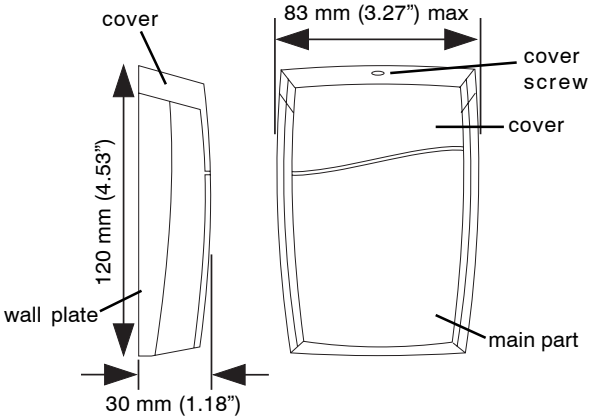
- Non-dispersive infra-red (NDIR) technology
- Digital electronics - intelligent sensor
- Analogue outputs 10 V or 20 mA for both CO_2 and temperature
- RS232 port for configuration and calibration
- 24 Vac/dc supply
- Links configure outputs V or I, and start point (0% or 20%)
- Analogue output range and scaling programmable

Physical

Duct Sensor



Space Sensor



APPLICATIONS

Carbon dioxide is acknowledged as a good indicator of occupancy within a space. Ventilation control based on CO_2 levels saves energy. Proper ventilation also helps clear the air, reducing floating toxins and organic compounds that hang in the air, and the spread of common viruses and bacteria that lead to temporary sickness and lost productivity.

Suitable applications include monitoring and controlling CO_2 levels according to indoor air quality guidelines, (e.g. ASHRAE 62-1989), activating a high limit alarm in CO_2 usage areas, and other CO_2 monitoring applications such as greenhouses, mushroom farms, food storage etc.

- Minimum detected ambient CO_2 concentration: 270 ppm.
- Typical ambient CO_2 concentrations: 350 to 450 ppm.
- National Boards of Occupational Safety and Health recognise CO_2 concentration as an indicator of Indoor Air Quality (IAQ) in occupied spaces; a concentration of below 1000 ppm should be aimed for.
- ASHRAE standard for maximum CO_2 concentration (adopted as recommended maximum in most European countries): 1000 ppm.

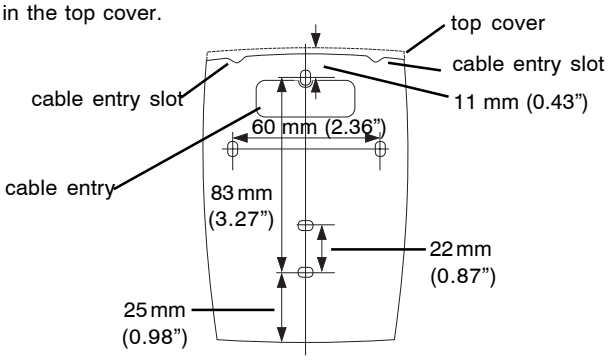
FUNCTIONALITY

Sensors

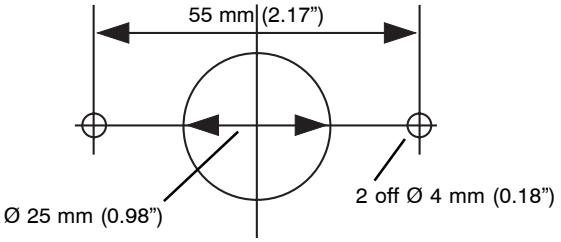
This sensor uses non-dispersive infra-red technology to sense CO_2 concentrations in ppm. Its all-digital signal processing design enables high accuracy and output versatility. Any long term drift is taken care of by its automatic baseline correction (ABC) algorithm. The sensor uses a thermistor to measure ambient temperature.

Hardware

The space sensor consists of a wall mounting unit. The top cover is removed by undoing the single cover screw and sliding it from the unit. The main body is then separated from the wall plate by pushing the main unit up and tilting it forwards. The wall plate has 5 mounting holes and should be screwed to the wall by a minimum of two screws. Cables can either be brought in from the back through the wall plate, or from the top via two knockouts in the top cover.



The duct sensor consists of a box and a sampling probe. The sampling probe is mounted in the duct by drilling a 25 mm hole for the probe, and two 4 mm holes for the screws. The probe is screwed to the duct using the rubber gasket and the two screws and washers provided. The duct sensor box has a lid fixed by a plastic clip, and 4 cable gland knockouts (three PG9, one PG7). The sensor is supplied with one PG7 gland, and one PG9 gland. The box is fixed to the probe by firstly carefully laying the thermistor sensor down into the probe The mechanical connection of the box to the probe is polarised with one large notch and three smaller notches so that the box is offered up to the probe with the large locking projection on the probe locating into the large notch in the box. The box is then pushed onto the probe against the 'O' ring gasket (supplied) and twisted to lock the box in position.



Software

The programming of parameters, and calibration are performed using the User Interface Programme (UIP-"Strategy"). This runs under Windows 95, 98 or NT. Connection to a PC is made locally via the sensor's RS232 port using the special 9 way D type female to 5 way in line adaptor cable. The UIP, adaptor cable, and User's Manual are supplied in the CO2/RKVT calibration kit. The UIP software and Users Manual are also available via the Web (see below, ORDER CODES).

Self Diagnostic Check

A full system test is executed automatically every time the power is turned on. In addition during operation, the sensor probes are constantly checked for failure by checking their valid dynamic measurement ranges. All EEPROM updates, initiated by the sensor itself, as well as by external connections, are checked by subsequent memory read back and data comparisons. These different system checks return error bytes to the system RAM. The error codes listed below are shown in the UIP program running on a PC which is connected to the RS232 port of the sensor using the special 9 way D type female to 5 way in-line adaptor cable. Warm up and out of range are the only bits that are reset automatically after a return to normal state. All other error bits have to be reset manually after return to normal by power off and restart

- 00 no errors
- 01 Fatal Error; try restart
- 02 Reserved
- 04 Algorithm Error (wrong EEPROM configuration); try restart, check software using UIP program
- 08 Output Error (error in calculation and generation of output signals); check output connections and loads, check status of outputs with UIP program
- 16 Self Diagnostic Error (may indicate need for zero calibration or sensor replacement); Check self diagnostic status with UIP program
- 32 Out Of Range Error (accompanies most other errors, also indicates failures of sensors and inputs); check connections of temperature and relative humidity probe, check detailed status of measurements with UIP program
- 64 Memory Error (non fatal during memory operations); check detailed settings and configuration with UIP program.
- 128 Warm Up State (always occurs after power up or power failure); should disappear after 30 s, if not check power stability)

The errors are in a binary code and can be added together so an error code of 40 would result from a combination of Output Error (8) and Out of Range Error (32).

When any error is detected the yellow LED will flash.

Analogue Outputs

Both linear analogue outputs are configured by default so that output OUT1 produces 0 to 10 V for a gas concentration of 0 to 2000 ppm, and OUT2 produces 0 to 10V for a temperature range of 0 to +50 °C (+32 °F to +122 °F). The output signals for each channel can be changed independently to be either 0 to 10 V or 0 to 20 mA using on board links. The start point of the output range can be changed for both channels (not independently) using one link to be either 0% (0 V or 0 mA), or 20 % (2 V or 4 mA).

Configuration

The default configuration provides a functional sensor as described above, however if required it may be configured using the UIP software. This enables the two analogue outputs to become functions of both inputs (CO_2 and temperature). The inputs can be rescaled, offset and combined as required

LED indicator

There is one yellow LED sensor which flashes after each measurement cycle during which an error has occurred.

INSTALLATION

The sensor should be mounted in a location representative of the area to be controlled (e.g. in the controlled air space, or the return duct). Locations with direct draft as well as badly mixed air should be avoided. (Note that a direct draft will interfere with the internal self heating compensation and will reduce temperature measurement accuracy).To reduce risk of damage or direct exposure to human exhalation the space sensor should be placed at least 2 metres (6'6") above the floor.

The installation procedure consists of:

- wiring sensor (outputs, power)
- mounting sensor
- setting links
- applying power - checking yellow indicator?
- setting up IQ
- checking sensor operation
- changing parameters (if required)

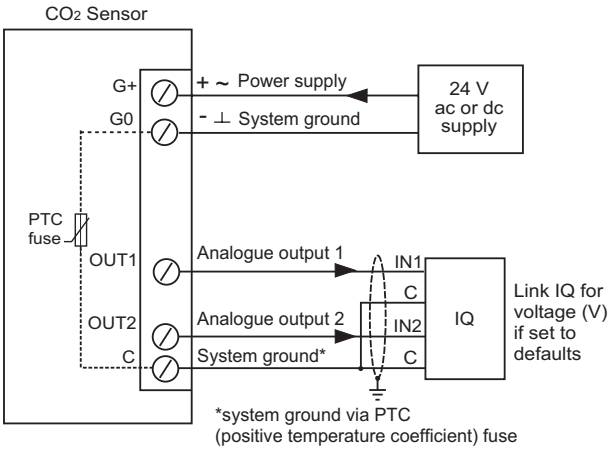
The space sensor is mounted by partially dismantling the unit and mounting the wall plate. The main body of the sensor then clips onto the wall plate.
The duct sensor is mounted by drilling 2 fixing holes and 1 sensor probe hole. The sensor box is fixed to the probe by a quick twist bayonet fixing. In duct mounting applications it is essential to check that there is no leakage from the room environment into the duct mounting box.

Full details are given in the CO2+T/S Space CO_2 Sensor Installation Instructions TG102191 and CO2+T/D Duct CO_2 Sensor Installation Instructions TG200091.

CONNECTIONS

Wire the supply to the sensor (either 24 Vac or 24 Vdc)

Wire the output signals to the IQ controller.



Note that the sensor signal ground is connected to the power supply return via a PTC fuse. Ensure the same ground is used for the IQ controller. For IQs with a 24 V (ac or dc) supply check that the IQ can accept grounded inputs; if not, either suply the sensor from the IQ auxiliary suply, or use an isloated supply

Note that with the default settings, OUT1 is the CO_2 output and OUT2 is the temperature output, but this may be changed by configuring using the UIP program.

The IQ controller sensor type needs to be configured to match the sensor output range and proportional band. See specification for sensor type settings needed for a sensor with default settings.

DISPOSAL

WEEE Directive :

At the end of their useful life the packaging, and product should be disposed of by a suitable recycling centre.
Do not dispose of with normal household waste. Do not burn.

MAINTENANCE

Shipment and poor handling may result in a change of zero point which should be checked after installation is completed.
The recommended calibration interval is 5 years.
Calibration can be performed using the UIP User Interface Programme. This is described in the User Interface Program User's Manual.

The space sensor should be cleaned periodically using a damp cloth. Gently wipe external surfaces clean.

Check the duct sensor box and the sample tube for dust and dirt when inspecting the ventilation system. If necessary, blow them clean.

ORDER CODES

CO2+T/S	CO_2 Space Sensor
CO2+T/D	CO_2 Duct Sensor
CO2/RKVT	Calibration kit for units post 04/97, containing User Interface Program (UIP - also named 'Strategy'), the UIP User's Manual, and the 9 way D type female to 5 way in-line adapter cable. This enables both calibration and configuration.
CO2/ZERO	Zero CO_2 test gas cylinder. Required for calibration of sensor when using calibration kit (both pre and post 04/97).
CO2/VALVE	Valve for gas cylinder including 3 mm tube (both pre and post 04/97)
CO2/RK	Calibration Kit pre 04/97 containing User Interface Program, adapter cable, plastic gas tube and rubber blanket.
CO2/CAL	1700 ppm CO_2 test gas cylinder. Required for calibration of sensor when using calibration kit (pre 04/97 only).

Note that the UIP program and user's manual are available free-issue from the following website ***www.senseair.com.***

SPECIFICATIONS

Measurement

Temperature

Operating principle	Thermistor
Measurement Range	:0 to 50 °C (32 °F to 122 °F) (default), -20 to +60 °C (-4 °F to 140 °F) (maximum configurable)
Accuracy	:±0.5 °C (±0.9 °F)

CO_2

Operating principle	:Non-dispersive infra red (NDIR)
Gas sampling mode	:Diffusion
Measurement range	:0 to 2000 ppm (default), 0 to 3000 ppm (maximum configurable), numerical resolution 1 ppm
Accuracy	:±1% measurement range, ±5 % of reading (within ±10 °C, ±18 °F, calibration temp)
Long term drift	:ABC (automatic baseline correction) target 400 ppm, period 8 days
Annual zero drift	:<±0.3% measurement range
Response time	:2 min diffusion (20 s with tube connection at 0.1 l/min)
Warm up time	:<= 1 min (<=15 min at full spec.)
Pressure dependence	:+ 1.58 % reading per kPa deviation from 100 kPa
Calibration adjustments	:zero and span via RS232 port
Calibration procedure	:Automated with User Interface Program (UIP)
Calibration interval	:5 years
Sensor Life Expectancy	:>15 years

Electrical

Power Requirement	:24 Vac/Vdc ±20%, 50 or 60 Hz
Power Consumption	:<=3 Watts
Analog Outputs	:2 off, 0 to 10 Vdc (by default) R_{out}<100Ω, R_{load}>5kΩ (Can be changed to 4 to 20 mA by linking, R_{load}<500Ω - see Functionality section above)
Resolution	:10 bits (10mV/0.016 mA)
D/A conversion	:accuracy ±2% of measurement, voltage ±50 mV, current ±0.3 mA
Response Time	:2s
Protection	:PTC fuse (auto reset), short circuit safe
Data Interface	:RS232 serial port
IQ scaling	:for sensor with default settings
Defaults	:OUT1, 0 to 10 V for 0 to 2000 ppm, CO_2 :OUT2, 0 to 10 V for 0 to 50 °C (+32 °F to +122 °F), Temp

If the output configurations have been modified from the defaults, the IQ scaling settings will be different. See Sensor Scaling Reference Card for details on how to calculate the settings.

The input channels must be set up for analogue voltage, V, and correct scaling. It is recommended to use SET (software tool) for the setting of the sensor type module. For all IQ2 series controllers with firmware v 2.1 or greater, or IQ3 seres controllers, the following SET Unique Sensor References should be used:

humidity: **CO2 V**
temperature: **Temp V 0+50** (°C)
Temp V+32+122 F (°F)

Alternatively enter the values manually as defined in the tables below with scaling mode 5 (characterise). For all other controllers see the Sensor Scaling Reference Card, TB100521A.

CO_2 output (default OUT1)
Use sensor type scaling mode 5, characterise with input type set to 0 (volts, V) and the table below.

Y	Input type	0 (volts V)
E	Exponent	4
U	Upper	2000
L	Lower	0
P	Points	2
n	**In**	**On**
1	0	0
2	10	2000

System Accuracy
(including controller)
:±23 ppm ±5% reading
(0 to 2000 ppm, 20 to 25 °C)

Temperature output (default OUT2)
Use sensor type scaling mode 5, characterise with input type set to 0 (volts, V) and the table below.

Y	Input type	°C	°F
E	Exponent	3	
U	Upper	50	122
L	Lower	0	32
P	Points	2	
n	**In**	**On**	
1	0	0	32
2	10	50	122

System Accuracy
(including controller)
:±0.6 °C ±2% reading
(0 to +50 °C)

Mechanical

Mounting	Space	:Removable wall plate for 2 off 4 mm screws
	Duct	:25 mm (0.83") probe hole with two screw fixing to duct; bayonet fixing of probe to sensor box (screws and gasket provided)
Dimensions	Space	:83 x 120 x 30 mm (3.27 x 4.53 x 3.27")
	Duct	:83 x 140 x 45 mm (308 (12.13") including probe) (3.27 x 5.51 x 1.77")
Weight	Space	:185 g (6.5 oz)
	Duct	: 640 g (22.5 oz)
Connections		:(main block) Screw terminals, 1.5 mm^2 (16 AWG) max
RS232 connection		:5 pin, 2.54 mm pitch , slide connector

Environmental

Storage Temp.	:-20 °C to +70 °C (-4 °F to 158 °F)
Operating Temp.	:0 °C to +50 °C (32 °F to 122 °F)
Humidity	:0 to 95 %RH non-condensing
Compliance	:EMC Directive 89/336/EEC

Indicators

Yellow LED	:Flashes when error is detected by self-diagnostic routine.

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Trend Control Systems Limited
P.O. Box 34, Horsham, West Sussex, RH12 2YF, UK. Tel:+44 (0)1403 211888 Fax:+44 (0)1403 241608 www.trend-controls.com
Trend Control Systems USA
6670 185th Avenue NE, Redmond, Washington 98052, USA. Tel: (425)897-3900, Fax: (425)869-8445 www.trend-controls.com